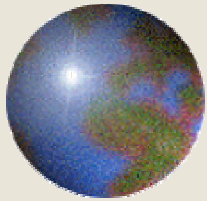


Enterprise Architecture

John McManus

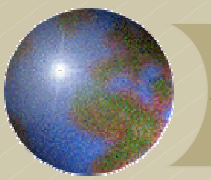
Chief Technology Officer, Code AO



Building Enterprise Information Architectures

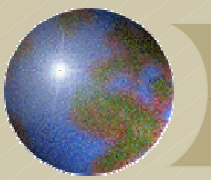
Reengineering Information Systems

Melissa Cook
Prentice Hall
ISBN 0-13-440256-1



Synopsis - Enterprise Architecture

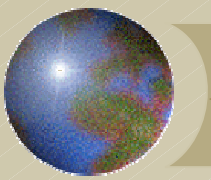
- ✿ This session will cover the fundamentals of enterprise architecture and how enterprise architecture is used as a tool.
- ✿ We'll cover the basic elements of an enterprise architecture and the process for developing and maintaining one.
- ✿ This will help us understand how NASA's diverse Agency, Enterprise and business requirements direct the development and revision process.
- ✿ We'll cover the emerging Federal Enterprise Architecture guidance and the NASA enterprise architecture



Enterprise Architecture

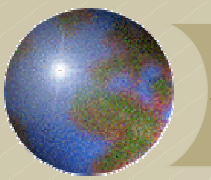
- ✚ Enterprise Architecture (EA) is a strategic tool
 - ▣ Links an Enterprise's Missions and Programs to IT Strategy.
 - ▣ EA identifies strategic IT focus areas in support of the agency mission

The framework that EA provides reduces the complexity of IT systems and enables effective and efficient deployment of new technology



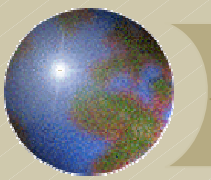
The Focus

- ✚ Focus on the business views
 - ✚ The Enterprise Architecture should be based on the data and processes necessary to run your business
 - ✚ If you do not understand your data and processing needs, you have bigger problems than an Enterprise Architecture can solve



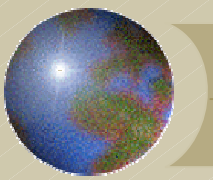
Preface

- ❖ The business views of your EA should be based on the data and processes needed to run your business
- ❖ If you do not understand your data and processing needs you have problems EA can not correct
- ❖ The framework that the EA provides reduces the complexity of information systems and enables the enterprise to effectively and efficiently deploy new technologies



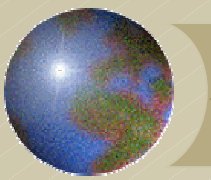
Scope

- ❖ The high-level architecture does not change the tactical decisions to employ new technology
- ❖ At the lowest levels of the architecture the technologists define the tactics and apply technology to the framework



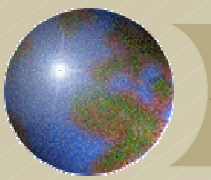
Build from the fundamentals

- ❖ Separating the business view from the technology view allows us to enable faster technology deployment
- ❖ Working from the process and requirements allows us to hold those fairly constant while technology changes



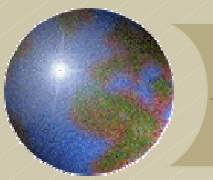
Centralized vs. Distributed approaches

- ❖ Enterprise Architecture provides the central authority and control (*governance*) required to migrate from a controlled, centralized approach to a controlled distributed approach
- ❖ Enterprise Architecture also provides the central authority and control (*governance*) required to migrate from a uncontrolled, distributed approach (*anarchy*) to a controlled distributed approach



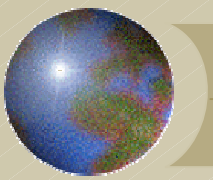
Gaining support for EA efforts

- ❖ Gaining the support of the Enterprise is often the most difficult task
 - ❑ People are afraid of losing “control”, their jobs, or creativity
- ❖ Apply standards only where interoperability is important
 - ❑ Need to make intelligent choices on when and where to standardize
 - ❑ Properly applied, standards increase creativity by allowing people to focus on the difficult tasks



The Vertical Approach to Systems

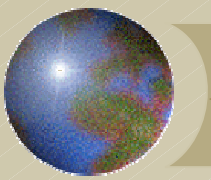
- ⊕ Designed from a “single” perspective
- ⊕ Optimized to solve a single view
 - ⊞ One set of data
 - ⊞ Proprietary hardware and software technologies
- ⊕ Grow to automate everything in the organization
 - ⊞ Redundant views
 - ⊞ Redundant processes



The Zachman Framework

⊕ Horizontal approach

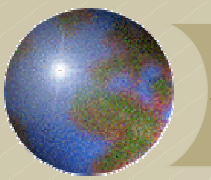
- ⊞ Separate data, process and technology architectures that unite into form a common Enterprise Architecture
 - Process Architecture built on activities
 - Data Architecture built around facts or form
 - Technology Architecture built around physical constraints
- ⊞ Developed concurrently using a iterative approach



The Zachman Framework -details

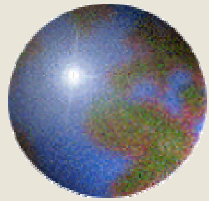
- ❖ Six views of each architecture (3 x 6 matrix)
 - ❖ Ballpark View
 - ❖ Owner's View
 - ❖ Designer's View
 - ❖ Builder's View
 - ❖ Detailed Representation (Design documents)
 - ❖ Functioning System (“as-built” documents)

The current NASA effort is focused on the top two levels of the Enterprise Architecture

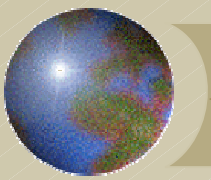


Characteristics of the Architect

- ⊕ Well-rounded line management experience
 - ⊞ Strong business background
 - ⊞ Strong technical background
- ⊕ Broad understanding of the enterprise vision
 - ⊞ Sees the big picture
 - ⊞ Ability to see the “patterns” across the enterprise

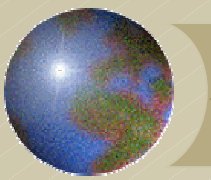


Updating the NASA Enterprise Architecture



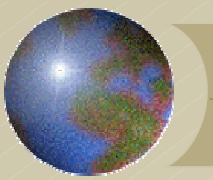
NASA's Six Strategic Enterprises

- ✚ Aerospace Technology (R)
- ✚ Biomedical and Physical Research (U)
- ✚ Earth Science (Y)
- ✚ Human Exploration and Development of Space (M)
- ✚ Space Science (S)
- ✚ Education (N)



NASA's Lines of Business

- ✚ Economic Development
 - ✚ Business / Industry Development
- ✚ Education
 - ✚ Education and Cultural Institutions
- ✚ Energy
 - ✚ Energy Resource Management
- ✚ Environmental Management
 - ✚ Environmental Monitoring and Forecasting



NASA's Lines of Business (continued)

✚ General Science and Innovation

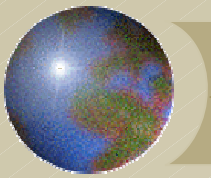
- ✚ Scientific Innovation
- ✚ Space Flight Innovation
- ✚ Technological Innovation

✚ International Affairs

- ✚ Foreign Affairs

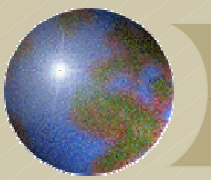
✚ Workforce management

- ✚ Training and Employment



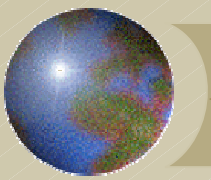
Why update the NASA EA now?

- ⊕ Security
- ⊕ Emerging enterprise-wide services and applications are fundamentally changing the NASA working and service delivery models
- ⊕ Current Enterprise Architecture is outdated
 - ⊕ Does not support the OneNASA vision
 - ⊕ Limits service delivery and technology choices
- ⊕ External Influences on IT programs



What's the Process we are applying?

- ❖ Document the current or “as-is” state
 - ❑ This includes requirements, processes and infrastructure
- ❖ Set priorities
 - ❑ View the problem space from an agency perspective
- ❖ Define the future or “to-be” state
 - ❑ Need to consider the realities of timing and funding
 - ❑ Start with the “what” and work to the “how”



External Influences

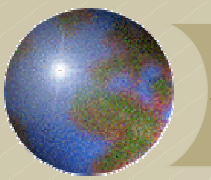
● Federal Enterprise Architecture

- OMB is leading the Federal Enterprise Architecture Program
- www.feapmo.gov
- Based on a common set of reference models
- We are participating in two subcommittees
 - Component Technologies
 - Governance Models

● E-Gov Act

- Initiatives to “open” services to the citizens
- Agency and Government-wide processes and applications

● Security



Internal Influences

- NASA Strategic Plan

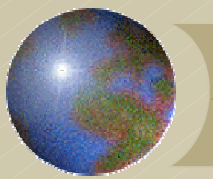
- Enterprise-wide programs and services

- NASA's Strategic Enterprises

- Aerospace Technology
- Biomedical and Physical Research
- Earth Science
- Human Exploration and Development of Space
- Space Science

- Institutional Requirements

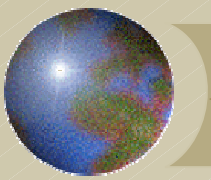
- Internal Service Providers



NASA Strategic Plan

Implementing Strategy-2 (IS-2)

- ✚ By 2005, NASA plans to implement the following measures:
- ✚ Provide all NASA operations with secure, highly reliable, interoperable information systems
- ✚ Enable NASA people to communicate across and integrated, low-cost information technology infrastructure
- ✚ Design and operate a One NASA network to improve organizational interactions and foster improved collaboration and sharing of accumulated NASA knowledge assets
- ✚ Establish systems to deliver superior information services to consumers, educators, students, researchers, and the general public, as well as to Government agencies, NASA contractors and suppliers, and other businesses



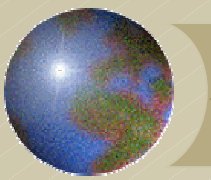
Enterprise and Institutional Requirements

✿ Enterprise Requirements

- ✚ Solicited from the five Enterprise teams
- ✚ Focus on the Enterprise perspective
 - Mission and Program support
 - Services to the Citizen

✿ Institutional Requirements

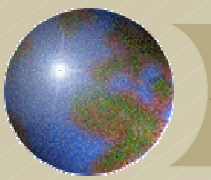
- ✚ Focus on providing secure, reliable services and infrastructure to the Agency
 - IT Security
 - Agency-wide Services (i.e., Travel, Time and Attendance)
 - Wide Area Networking
 - Local Area Networking



Changing Service Delivery Models

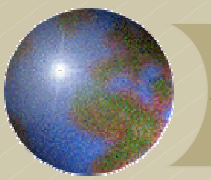
IFM as an example

- ✿ We are moving to enterprise-wide service delivery models
 - ✦ Architecture and Infrastructure must evolve in a coordinated way
 - ✦ Security models must evolve
- ✿ Lessons learned from the IFM implementation led to the following “flash point” issues with the Agency’s current IT infrastructure:
 - ✦ Inconsistent firewall configurations at each Center
 - ✦ Potential network latency
 - ✦ Inconsistent and multiple numbers of desktop configurations
 - ✦ Macintosh platform issues
 - ✦ Inability to “push” software from a central site for updates and refreshes



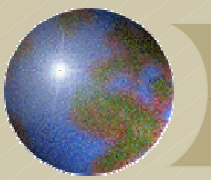
Governance Model(s)

- Models used to ensure consistency
 - Process and Implementations
 - Multiple approaches including Change Control Boards
- Items fall in different areas and are handled differently
 - Centrally Controlled, Centrally Administered
 - e.g., WAN Perimeter Security
 - This should be a select set of items
 - Centrally Coordinated, Locally Administered
 - e.g., LAN Perimeter Security
 - Policy coordinated by the CIO Board or a board it assigns
 - Locally Controlled, Locally Administrated
 - Center or Enterprise Specific items
- We need to make intelligent, Agency focused decisions



High Level Requirements

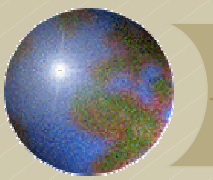
- ✚ The NASA Enterprise Architecture must
 - ✚ be consistent with the Federal Enterprise Architecture
 - ✚ support NASA's strategic enterprises
 - ✚ allow NASA to provide services across the diverse citizens business areas (E-Gov)
 - ✚ support NASA's internal operations and infrastructure.



Developing the “to-be” or Target Architecture

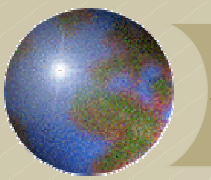
✚ Key Considerations:

- ✚ Alignment with the Agency and Enterprise’s strategic plans
- ✚ Must be economically and technically achievable
- ✚ Focus on areas or information needs with the highest payoff
- ✚ Develop conceptual models to facilitate discussions
- ✚ Focus on the “Big Picture”
- ✚ Recognize information is a strategic resource that we need to manage
- ✚ Metrics
 - Select metrics
 - Collect data
 - Assess progress



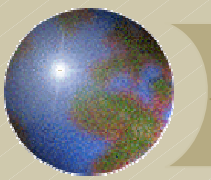
Key Questions to Consider

- ❖ What are the strategic objectives of the organization?
- ❖ What information is needed to support the organization?
- ❖ What applications are needed to provide information?
- ❖ What technologies are needed to support the applications?



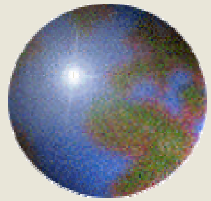
The End State

- ✚ The Target Architecture should:
 - ✚ Reflect our view on the future uses and characteristics of information within the Agency
 - ✚ Reflect our requirement for focusing on opportunities to automate/simplify access to information
 - ✚ Incorporate Technology Forecasts
 - ✚ Address the level of interoperability required between data sources and users of the data
 - ✚ Identify the IT required to support the Agency's technical objectives
 - ✚ Reflect reality
 - Budget issues
 - Territorial concerns

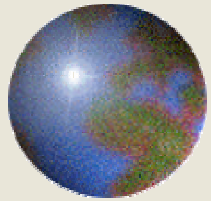


Our Next Steps

- ❖ Collect the wealth of existing information
 - ❑ NASA Strategic Plan
 - ❑ Enterprise Strategic Plans
 - ❑ Past efforts in IT Strategic Planning
 - Office of the Future
 - Advanced Data Visualization
 - IFMP
- ❖ Baseline the Existing Architecture



Backup Slides



Notes Section